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AUTHOR Vedra, Kenneth David
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ABSTRACT

School district bond ratings, issued on request by Standard and Poor's Corporation or Moody's Investors Service, hold implications for school districts' financial management. Ultimately, the bond rating assigned is a factor affecting the total cost of the bond issuance, related to the principal and interest payments over the life of the debt. A study was designed to identify the relationships among (1) school district bond ratings given by Moody's; (2) various socioeconomic-demographic characteristics; (3) and educational organization and finance variables. The 33 school districts selected for the study were all districts receiving a general obligation bond rating in 1984 from Moody's and located within a standard Metropolitan Statistical Area in the Western region. Each of 19 independent variables was tested for simple correlation; a multiple regression equation was developed to predict Moody bond ratings. The findings indicate that four variables (assessed valuation, total bonded debt, overlapping debt, and fund balance) have a combined predictive value that is highly significant. Combining these four variables yields a strong positive correlation with Moody's bond ratings. Findings also show that socioeconomic-demographic variables (per capita income, median family income, and district population) are not significant in the prediction equation. Therefore, these variables do not discriminate in the determination of a district's bond rating. Other findings and implications are discussed at length. Six statistical tables are included. (MLH)

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A STUDY OF THE PREDICTABILITY OF SCHOOL BOND RATINGS

by
Kenneth David Vedra
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Executive Director, Business and Finance
Adams County School District No. 50
Westminster, Colorado 80030

Submitted to the American Association of School Administrators as a result of the call for papers for the Outstanding Research Presentation Award.

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STUDY OF THE PREDICTABILITY OF SCHOOL DISTRICT BOND RATINGS

STATEMENT OF THE PROBLEM

School district bond ratings, issued on request by either or both Standard and Poor's Corporation or Moody's Investors Service, hold implications for the financial management of school districts. Generally, lower bond ratings result in higher interest rates on the principal amount of the obligation when other market factors are held constant. Conversely, higher bond ratings result in lower interest rates on the principal amount of the obligation, when other market factors are held constant. Ultimately, the bond rating assigned is a factor which affects the total cost of the bond issuance, related to the principal and interest payments, over the life of the debt. The lower the bond rating, the higher the total debt cost; conversely, the higher the bond rating, the lower the total debt cost when other market factors are held constant at a point in time in the market. The problem identified in this study involved the identification of relationships between school district bond ratings, given by Moody's Investors Service, and various socioeconomic-demographic characteristics and educational organization and finance factors of the school district. These findings hold implications for school district management practices.

Questions arise as to whether socioeconomic-demographic characteristics and educational organization and finance factors are related to school district bond ratings. The implications of these relationships are:

1. if educational organization and finance factors, capable of being manipulated by the local school board and administration, are

related to bond ratings, then changes in management practice could result in bond interest cost savings to school districts;

2. if socioeconomic-demographic factors are related to bond ratings, the possibility exists that school districts with certain socioeconomic-demographic characteristics are suffering economic discrimination in the form of lower school district bond ratings and consequently higher costs of servicing bond issues;

3. if a combination of socioeconomic-demographic characteristics and educational organization and finance factors can explain a large amount of the variance in school district bond ratings, the possibility exists that school districts could forecast ratings and take corrective actions prior to approaching the bond ratings companies.

The questions arising from the problem statement which are to be used to guide the research design and methodology are summarized as follows:

1. What relationships exist, if any, between school district socioeconomic-demographic characteristics and educational organization and finance variables and bond ratings issued by Moody's Investors Services?

2. What are the implications of these relationships, or lack of relationships, for school district governance, management and instructional organization activities?

3. What are the implications of these relationships, or lack of relationships, for school districts seeking an investor service bond rating?

4. What are the implications of these relationships, or lack of relationships, for social equity and equality of educational opportunity afforded in school districts?
5. What are the implications for the development of a mathematical model which allows school districts to utilize a multiple regression equation to predict bond ratings?

This research will be of value to school district administrators because it will provide information which can be analyzed and applied to their own individual situation as it relates to providing more effective financing for capital projects.

DESIGN AND PROCEDURES

The problem of this study was to identify the relationships between school district bond ratings given by Moody's Investors Service and various socioeconomic-demographic characteristics and educational organization and finance factors of school districts.

Several variables related to school district bond ratings were identified. Data sources included Moody's Municipal Credit Report on each of the studies school disstricts, from 1980 United States Census Bureau data and selected school districts' official statements (prospectus).

Through the analysis of school districts' socioeconomic-demographic characteristics, educational organization and finance factors and existing bond ratings, a bond rating predictor equation will be developed. Applying this equation to future school district bond issues, a predicted bond rating for the issuance will be derived. This equation will assist school district management with determining the total cost of issuance and necessary debt

structure for a school district. Working with the equation, it will be possible for the management of the school district to develop various scenarios for bond ratings by manipulating factors which are within their control. This may result in changes in management practices which results in an enhancement of the districts' bond rating. This would provide interest savings to the school district over the life of the debt.

The following procedures were followed to build the model used to construct the bond rating predictor equation:

1. Thirty-three SMSA school districts that received a general obligation bond rating in 1984 from Moody's Investors Service in their Western Region of the United States were tested. Moody's Western Region includes the states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. (Source: Moody's Municipal Issues, p. 8, v. 3, n. 1, February 1986.)
2. The socioeconomic-demographic characteristics of the selected school districts were obtained from the United States Census Bureau records for 1980 and from Moody's Municipal Credit Reports on the individual school districts. The characteristics to be included were: logarithm of the total bonded debt of the school district, logarithm of per capita income, logarithm of population, logarithm of the total assessed valuation, logarithm of the full valuation of property, logarithm of bonded debt per capita, logarithm of overlapping bonded debt, logarithm of median family income, percentage of unemployment for residents of the school district, percentage of residential taxable property, percentage

of industrial and commercial taxable property, percentage of property taxes collected, percentage growth in assessed valuation, logarithm of the amount of short-term debt owed by the school district, percentage of principal debt retired after ten years, total tax levy of the school district, availability of a separate debt service fund, logarithm of the amount of fund balance in the general operating fund of the school district, and school district involvement in litigation.

3. The existing general obligation bond ratings were analyzed to identify simple correlations between socioeconomic-demographic characteristics, educational organization finance factors and the bond rating received. Pearson's Product Moment Correlation Coefficient measure was used to determine the correlation coefficients between the various characteristics and the bond rating received. Part and partial correlations between characteristics were calculated and used in determining the order for the variables in the stepwise multiple regression equation.
4. Based upon the simple correlation coefficients obtained and the part and partial correlation results, a stepwise multiple regression equation was developed which predicted bond ratings based upon the socioeconomic-demographic characteristics and educational organization finance factors.

THE POPULATION

The thirty-three school districts selected for the study were all of the school districts which received a general obligation bond rating in the 1984

Moody's Investors Service, lie within a Standard Metropolitan Statistical Area (SMSA) as defined by the 1980 United States Census, and lie within Moody's Western Region which is made up of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. Within this region, there were a total of 75 school districts which received a general obligation bond rating. The source of the total number of school districts receiving general obligation bond ratings was Moody's Municipal Department 1984 Annual Index of Municipal Credit Reports.

VARIABLES AND SOURCE COLLECTION

The dependent variable, Y, is the bond rating assigned by Moody's Investors Service for school districts that issued general obligation bonds in Moody's Western Region, during 1984, and lie within a Standard Metropolitan Statistical Area (SMSA). The variables used in the study listed below:

X_1: logarithm of the total bonded debt of the school district,

X_2: logarithm of per capita income of residents of the school district,

X_3: logarithm of population of the school district,

X_4: logarithm of the total assessed valuation of the school district,

X_5: logarithm of the full valuation of property of the school district,

X_6: logarithm of bonded debt per capita of the school district,

X_7: logarithm of the overlapping bonded debt of the school district,

X_8: logarithm of median family income of the school district,

X_9: percentage of unemployment for residents of the school district,

X_{10}: percentage of residential taxable property of the school district,

X_{11}: percentage of industrial and commercial taxable property of the school district,

X_{12}: percentage of property taxes collected by the school district,

X_{13}: percentage growth in assessed valuation in the school district,

X_{14}: logarithm of the amount of short-term debt owed by the school district,

X_{15}: percentage of principal debt retired after ten years,

X_{16}: total tax levy of the school district,

X_{17}: availability of a separate debt service fund to pay general obligation debt for the school district,

X_{18}: logarithm of the amount of fund balance in the general operating fund for the school district,

X_{19}: school district involvement in litigation.

The variables listed above were selected for the study based upon their occurrence in other studies, information contained in official statements for school districts and listings in Moody's Municipal Credit Reports.

The major sources of data were: Moody's Municipal Credit Report, 1984; the 1980 United States Census Bureau documents; and Official Statements (prospectus) for the general obligation bonds of the school districts selected.

STATISTICAL TREATMENT

Each of the nineteen independent variables was tested for simple correlation using Pearson's Product Moment Correlation. All data used was either in its original form or converted to its base 10 logarithm for the study. Several of the variables were converted to logarithms because of the magnitude of the numbers involved in the study data and the overall effect the large numbers would have on the correlation results. Independent variables that were converted to logarithms were: total bonded debt of the school district, per capita income, median family income, population of the school district, total assessed valuation of the school district, full valuation of

property of the school district, overlapping debt of the school district, amount of short-term debt of the school district, bonded debt per capita, and amount of fund balance in the general operating fund for the school district. The following independent variables used in the study were dichotomous in nature and were converted to numeric data: availability of a separate debt service fund to pay general obligation debt of the school district, and school district involvement in litigation. In both cases, the numeric conversions were to 0 if no and 1 if yes. All other independent variables were used in their original data form.

Since the dependent variable, bond rating, was listed in letter notation, it was necessary to convert all ratings to numeric scale. Since bond ratings represent ordinal measures, the following scale was used to convert all bond ratings to numeric scale. Previously, Franceschini (1978) and other converted bond ratings from letter nomenclature to numeric ratings. These studies provided the precedent for the conversions. The scale was developed to allow all ratings, including Aa1, A1, Baa1, Ba1 and B1. The conversion scale has "C" rated bonds identified as the lowest and Aaa rated as the highest. Numerically, the C rated bonds were assigned a 1 rating while Aaa rated bonds received a 14. See Table 4.1 for the conversion listing.

TABLE 4.1
Bond Rating Conversion Table

Moody's Bond Rating Assigned	Numeric Conversion
Aaa	14
Aa 1	13
Aa	12
A 1	11
A	10
Baa 1	9
Baa	8
Ba	7
Ba	6
B 1	5
B	4
Caa	3
Ca	2
C	1

After all data was collected on the school district's general obligation bonds, it was input into the Computer Program for Statistical Package for the Social Sciences to derive means, standard deviations, standard errors, F values, multiple correlation, variance and significance.

The S.P.S.S. Computer Program was then used to select the order for the independent variables to be input into the stepwise multiple regression equation. Algebraically, the stepwise multiple regression equation is written as

$$Y = B_1 X_1 + B_2 X_2 + B_3 X_3 + . . . + B_{19} X_{19} + C$$

for this study. Y represents the assigned bond rating, X's represent the independent variables, and C is the constant. Stepwise multiple regression was selected as the statistical treatment because it will "...show the increment added by each predictor." (Glass, Hopkins, 1984, p. 137.) The best predictor is selected and used first with the other predictors (independent variables) added in the order in which they demonstrate their magnitude to predict the dependent variable and lack inter-correlation with independent variables.

Through Pearson's Product Moment Correlation analysis, variables correlating with school district general obligation bond ratings were identified. A multiple regression equation was developed, using stepwise regression, to predict Moody bond ratings.

PRESENTATION OF FINDINGS

Correlation coefficients were generated from the statistics subroutine within the S.P.S.S. program. The following independent variables were found to have high correlation with the dependent variable, assigned bond rating; assessed valuation of the school district and general operating fund balance. Table 4.2 lists the correlation coefficients for each of the nineteen independent variables with the dependent variable, bond rating assigned. There was no variance in the response on the availability of a debt service fund (a dichotomous variable requiring a yes or no response); therefore, a correlation could not be computed.

The two highest correlations for the independent variables were ultimately used in the stepwise multiple regression bond rating prediction

TABLE 4.2

Summary of the Pearson Product Moment Correlation Coefficients of Bond Rating Variables and Bond Rating Assigned for SMSA School Districts Receiving a General Obligation Bond Rating in Moody's Western Region

Variable		Abbreviation	P
X_1:	Log total bonded debt of the school district	TBDSD	.075
X_2:	Per capita income of residents of the school district	PCISD	.236
X_3:	Log population of school district	POPSD	.284
X_4:	Log total assessed valuation of school district	AVSD	.698
X_5:	Log of the full valuation of the school district	FVSD	.403
X_6:	Bonded debt per capita of the school district	BDPCSD	-.078
X_7:	Log overlapping bonded debt of school district	OBDSE	.427
X_8:	Median family income of school district	MFISD	.019
X_9:	Percentage unemployment for residents of the school district	PURSD	.267
X_{10}:	Percentage of residential taxable property of the school district	PRTPSD	-.013
X_{11}:	Percentage of industrial and commercial taxable property of the school district	PICTPSD	-.052

TABLE 4.2 (cont.)

	Variable	Abbreviation	P
X_{12}:	Percentage of taxes collected by the school district	PTCSD	.160
X_{13}:	Percentage growth in assessed valuation in the school district	PGAV	-.360
X_{14}:	Log short-term debt owed by the school district	STDSD	.505
X_{15}:	Percentage of principal debt retired during the first ten years after issuance	PDRHL	-.146
X_{16}:	Total tax levy of the school district	TTLSD	-.128
X_{17}:	Availability of a separate debt service fund	SDSF	991.000*
X_{18}:	Log of fund balance in general operating fund	FBGF	.660
X_{19}:	School district involvement in litigation	LIGIT	.034
X_{20}:	Bond rating assigned	MOODYR	Dependent Variable

*All responses to this variable were constant resulting in no variance.

equation. One of these two variables was an educational organization and finance variable. Since two of the four variables identified in the equation were educational organization and finance factors, the possibility existed that school district educational operation and finance factors may have equal weight in predicting school district general obligation bond ratings. Additionally, the correlation coefficients indicated that there was little correlation or relationship between median family income, percentage of residential property, involvement in litigation, total bonded debt and bonded debt per capita to the dependent variable, bond rating, on an individual basis. This is important because previous studies and bond literature have indicated that many of these variables may have an effect on the bond rating receiving. These variables were not found to be significant in this study.

DEVELOPMENT OF THE BOND RATING PREDICTION EQUATION

The bond rating prediction equation was developed using stepwise multiple regression techniques. This method was selected because it requires that variables be examined at each step for entry or removal from the equation and demonstrates the increment added by each predictor.

The multiple correlation for the stepwise model yielded a combined correlation of .8597. The amount of multiple correlation added by each step is identified in the Table 4.4.

TABLE 4.4

Multiple Correlation Added at Each Step of the Bond Rating Prediction Equation

Step Number	Variable Name	Multiple R Added	Total Multiple R
1	Assessed Valuation	.6980	.6980
2	Total Bonded Debt	.0926	.7906
3	Overlapping Debt	.0395	.8301
4	Fund Balance	.0296	.8597

The combined amount of variance explained by the four independent prediction variables on the dependent variable was 73.91 percent. The adjusted amount of variance accounted for in the equation equaled 70.18 percent. Table 4.5 shows the amount of variance accounted for by each of the predictor variables at each step.

The standard error of estimate equaled .6273. This indicates that two thirds of the predicted scores will be within $\pm$ .627 standard deviations of the predicted value. This tight distribution will result in less variability in the prediction of the bond rating.

TABLE 4.5

Amount of Variance Added at Each Step of the Bond Rating Prediction Equation

Step Number	Variable Name	Multiple R Added	Total Multiple R
1	Assessed Valuation	.4872	.4872
2	Total Bonded Debt	.1378	.6250
3	Overlapping Debt	.0640	.6890
4	Fund Balance	.0501	.7391

The partial regression coefficients were computed and used to predict the bond rating in the equation. Each of the coefficients listed were adjusted for other independent variables in the equation. Table 4.6 reports the coefficient used in the equation.

TABLE 4.6

Partial Regression Coefficients (B) for Each Independent Variable Used in the Prediction Equation

Step Number	Variable Name	B
1	Assessed Valuation	1.42906
2	Total Bonded Debt	-1.22165
3	Overlapping Debt	.12414
4	Fund Balance	.46822
5	Constant	4.34623

The F test associated with analysis of variance was calculated to test if there was a linear relationship between the dependent variables and the predictor set of independent variables. The F score equaled 19.83183. This value exceeded 8.46 which is the critical F value for significance at the .05 level with 28 and 4 degrees of freedom. A linear relationship was established. Table 4.7 reports the analysis of variance results.

Stepwise multiple regression techniques were employed to select the independent variables used in the prediction equation. Stepwise multiple regression is actually a combination of forward selection multiple regression and backward elimination multiple regression. The first variable selected for entry into the equation is the one with the largest positive or negative correlation with the dependent variable. The second variable is selected based upon the highest partial correlation. After this point, F values are tested to determine if they are eligible for removal based upon the removal criterion, as in backward elimination. A probability to enter the equation of .05 was used.

TABLE 4.7

Analysis of Variance Results

Descriptor	Degrees of Freedom	Sum of Squares	Mean Square
Regression	4	31.22204	7.80551
Residual	28	11.02038	.39359

F = 19.83183; Significant F = .0000

This process allows variables entry into the equation only if the probability of meeting the F test requirement is less than or equal to .05.

The independent variables which met this criteria were assessed valuation of the school district, total bonded indebtedness of the school district, overlapping debt and general operating fund balance. As a result of variable selection process, the bond rating prediction equation is written as follows:

Predicted Bond Rating = 1.42906 (log assessed valuation) - 1.22165 (log total bonded debt) + .12414 (log overlapping debt) + .46822 (log fund balance) + 4.3462

The findings of the data determined that there were four independent variables: assessed valuation, total bonded indebtedness, overlapping debt and general operating fund balance which could be used in the development of a bond rating prediction equation. In testing the equation with ratings that were used in the study, four predicted ratings matched the assigned rating.

SUMMARY AND CONCLUSIONS

Based upon the findings of the model, it can be concluded that four independent variables, of the nineteen that were studied, have a combined predictive value that is highly significant. Additionally, after combining the four independent variables, strong positive correlation was indicated with the bond ratings that were assigned by Moody's Investors Service.

Two of the four independent variables identified in the model, total bonded indebtedness of the school district and general operating fund balance, are variables which can be controlled by the school district. These two variables are considered to be educational organization and finance factors. The other two independent variables, assessed valuation of the school district and overlapping debt, are variables which are beyond the immediate scope of control of the school district. These hold important consequences for the model in answering the questions that guided the research.

The findings in the model identified two educational organization and finance factors that are able to be controlled by the school district. Thus, it can be inferred that school districts may be able to identify their bond ratings on future issuances by using the predicting equation and manipulating the numbers for the variables used in the equation. This would allow school districts to measure the effect that different scenarios of total bonded indebtedness of the school district and general operating fund balance have on the predicted school district bond rating.

The findings indicated that total bonded indebtedness of the school district has an inverse relationship to the bond rating received in the stepwise multiple regression equation. This may lead to the conclusion that

as bonded indebtedness increases, the predicted bond rating will decrease and conversely; as bonded indebtedness decreases, that the predicted bond rating will increase.

The findings of the model have also indicated that there is a positive relationship between general operating fund balance, at the end of a fiscal year, and the predicted bond rating generated from the model. This would indicated that as fund balance increases, the predicting bond rating may increase. This relationship would also suggest that as fund balances decreases, the predicted bond rating will decrease. These two findings hold important implications for school district governance, management and operation.

The other two independent variables included in the study, assessed valuation of the school district and overlapping debt, are variables over which the management and administration of the school district have no control. These two factors are directly related to the economic base of the community and its ability to provide for capital infrastructure. The district may be able to affect these two variables, but not through their direct control.

The findings indicate that socioeconomic-demographic variables such as per capita income, median family income and population of the school district are not significant in the prediction equation. This leads to the conclusion that socioeconomic-demographic variables do not discriminate in the determination of a bond rating for a school district.

The findings of the study are extremely important to school district managers because of the nature of the independent variables identified and because two of the four independent variables are educational organization and

finance factors, which school districts can control. Use of the prediction equation prior to receiving an actual bond rating, from a rating agency, on a bond issue should permit school district management to develop appropriate scenarios concerning management of the general operating fund, for fund balance purposes and optimal amount of bonded debt to be issued in order to optimize the bond rating received.

IMPLICATIONS OF THE FINDINGS

The study suggests several political, governance, and management implications for school districts related to their educational organization and financial operations. General obligation bond ratings represent the credit worthiness of a community. This holds potentially important political, governance and management implications for school districts. These potential implications deal with school districts' ability to incur general obligation debt and the associated repayment of the debt.

The findings of this study have indicated a strong, positive relationship between four variables, assessed valuation of the school district, total bonded indebtedness of the school district, overlapping debt of the school district and general operating fund balance and the bond rating assigned to school district general obligation debt by Moody's Investors Service. In the study each of the school districts' bond ratings were based upon the socioeconomic-demographic and finance factors of the community and the school district. In the stepwise multiple regression equation that was developed, an inverse relationship was identified between total bonded indebtedness of the school district and the predicted bond rating. This may imply that as school districts incur greater or lesser amounts of debt that

the resultant bond rating may be changed. This is a key governance and management issue. If such a relationship is correctly stated, then school districts much examine the conditions and purposes for which they choose to incur bonded indebtedness and these purposes relate to the school districts' educational program needs and their potential financial ability to pay. Since lower bond ratings reflect higher interest costs over the life of the debt, school districts may wish to look at the types of capital projects they undertake as they relate to the potential total cost of issuance. These potential impacts then become political questions that may affect bond indebtedness elections, the daily operations of the school district and school district management policies and procedures. Since school districts do not have control over all variables that affect a bond rating, they do have a responsibility to optimize the management of those factors which they can control within the parameters of their educational program and daily operations.

The second educational organization and finance factor found to be significant, in the development of the stepwise multiple regression equation, was general operating fund balance. This researcher would suggest that school districts examine management practices related to the general operating fund balance available at the end of each fiscal year for the following reasons: a surplus fund balance, in the event of a revenue loss or shortfall, would reduce the impact or likelihood of default of repayment of proceeds on bonded indebtedness, a surplus fund balance may reduce the amount of short-term debt that a school district needs for cash flow purposes thereby reducing repayment of obligatory debt, and the availability of surplus fund balance may indicate access by the school district management to contingency reserve funds in the

general operating fund in the event of an operational emergency within the school district. Since the general operating fund provides for the day-to-day operations of the school district and generally it is the largest fund which the school district manages, this fund is of particular importance to the rating agencies in that it can provide the basis for making judgments relative to the management and planning abilities of the school districts' administration and related governance policies of its board of directors.

One of the variables found to be significant in the study, assessed valuation of the school district, may be able to be indirectly influenced by the school district. The school district would accomplish this by working with various community groups to promote increases in the economic property base within the community. The result would be growth in assessed valuation. This may affect ad valorem taxes by reducing the amount of taxes paid by owners of property, thus, spreading the risk among more property owners.

The second variable that is part of the stepwise multiple regression predicting equation is overlapping debt of the school district. This variable is of importance to school districts and other general obligation debt issuing districts because the total debt to be repaid determine the tax levy which will be assessed against the assessed valuation of property within the issuing districts. The higher the outstanding debt, the higher the tax levy. Overlapping debt has serious consequences relative to the willingness of taxpayers to vote for approval on bonded indebtedness. This has a direct affect on the outcomes of bond elections and directs potential property tax limitation efforts within the population of voters. Because of overlapping debt, bond rating agencies may develop concerns about the ability and willingness of taxpayers to continue to support high debt levels and taxes.

This results in a determination by the bond rating agencies that there is additional risk associated with large amounts of overlapping debt that has one primary revenue stream; ad valorem taxes. This infers that in the event of an economic downturn that the likelihood for default on repayment on bond proceeds increases. This is because all general obligation debt is backed by the same full faith and credit revenue stream for all issuing entities.

There are other options available to school districts to improve or maintain their bond rating. These include changing state legislation to guarantee repayment of bonded indebtedness, development of bond banks at the state or local level, purchase bond insurance, development of state-operated general obligation bond rating agencies, and development of state administered capital project programs. These options should be researched fully to determine advantages and disadvantages of each for school districts and states.